

Serial No.: 10/688,541
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Customer No. 26,289
Attorney Docket No. 2001JP309

Remarks

The Examiner has required that the sheets submitted in the previous response be marked "Replacement Sheet". Such sheets have been submitted with the response.

The Examiner has rejected claims 1 and 3-16 under 35 USC 103(a) as being unpatentable over Nashua Corp. (WO 98/39755) in view of SAR PLC (EP 294,122), and further in view of Yano (US 6,621,635).

Claim 1 has been amended and new claims 17 and 18 added. The amended claim 1 now refers to an optical film, for use in a liquid crystal display which comprises a liquid crystal cell and a back light unit, comprising a layered product of (1) a reflective polarizer by which light is selectively P/S converted, which is disposed on the back light unit, and (2) a light scattering film that scatters and transmits light and comprises at least two phases having different refractive indices from each other, which is disposed on the reflective polarizer, wherein at least one of the phases which has the greater refractive index in the light scattering film has pillar structures extending in the thickness direction of the film, and further where the refractive index changes gradually at the interface of the greater refractive index phase and another phase, and furthermore the transmittance of the light scattering film in the normal direction of the film is not less than 4 %, and wherein an absolute value of a light incident angle where the scattering film has a maximum scattering performance is larger than zero degrees, when zero degrees is a light incident angle that light enters the film in the normal direction of the film.

The use of the liquid crystal display where the optical film is placed between the liquid crystal and a back light unit, the reflective polarizer is on the side of the back light unit, and the light scattering film is on the side of the liquid

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crystal is clearly disclosed in the specification at the bottom of page 1 to the top of page 2, 3rd paragraph of page 7, Example 1 and Figure 7. The novel relationship between the incident angle of light and the scattering performance is disclosed in the specification at the bottom of page 4 to the top of page 5, Figure 2, and bottom of page 8 to top of page 9. In detail, the incident angle with the maximum scattering angle is not in the normal direction (zero degrees) of the scattering film, but larger than zero degrees. New claim 17 refers to where the scattering performance of the scattering film is enhanced when the absolute value of the incident angle changes from zero degrees to the absolute value of the incident angle with a maximum scattering performance, and the scattering performance decreases after the absolute value of the incident angle with maximum scattering performance. New claim 18 refers to where the incident angle with a maximum scattering performance is around 20 degrees.

When the invented optical film, including the light scattering film and the scattering film disclosed by currently amended Claim 1, is used in the liquid crystal display, the optical film has unexpected effects in either transmission of light from the back light unit or in reflection of incident natural light, as shown in Examples of the specification of the application. The liquid crystal display having the optical film provided by the invention realizes a bright and visible excellent image in terms of both transmission and reflection states.

Bottom of page 7 to 2nd paragraph of page 8, Figure 3 and Figure 4 in the specification of the present application discloses how the light scattering film and the reflective polarizer work in transmission states. The reflective polarizer is placed between the light scattering film and the back light unit. As disclosed in currently amended Claim 1, when the incident angle of the light from the back

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light unit is zero degrees (normal to the film surface), the scattering performance is lower (the transmittance is larger). When the incident angle is not at zero degrees (in oblique line to the film surface), for example around 20 degrees, maximum scattering performance is achieved.

The light from the back light unit enters the reflective polarizer, which transmits only the P wave of the incident light as disclosed on page 7 1st paragraph in the specification of the application. When the light scattering film is irradiated by the P-wave light at various incident angles, the transmitted light intensity in the direction normal to the film is stronger than that in the oblique direction, for example, around 20 degrees. As a result, the light is collected around the direction normal to the film, because the scattered light of the incident light at the incident angle around 20 degrees contributes most intensely to the transmitted light in the normal direction. After the light is emitted through the liquid crystal cell, the brightness of the display is improved.

Bottom of page 8 to 2nd paragraph page 9, Figures 5 and 6 in the specification of the application discloses how the light scattering film and the reflective polarizer work in reflection states. After the natural light penetrates the liquid crystal cell and enters the scattering film at the oblique angle, for example, around 20 degrees, the incident light is collected around the direction normal to the film. As disclosed in currently amended claim 1, when the incident angle is not zero degrees (in oblique line to the film surface), for example around 20 degrees, there are an incident angle with a maximum scattering performance. As a result, the natural light with incident angles at the oblique angle, for example, around 20 degrees, contribute to the brightness in reflection, because the incident light with incident angles at the oblique angle, for example, around 20 degrees, is scattered most intensely. The transmitted light from the scattering film enters the reflective polarizer, which transmits only the P wave of the incident light as disclosed in page 7 1st paragraph in the

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specification of the present application. The transmitted P wave light enters the back light unit and is reflected by the back light unit. The reflected light is irradiated back to the reflective polarizer and the scattering film in the same way as the light from the back light unit in transmission states described above. After the light is emitted through the liquid crystal cell, the brightness of the display is improved.

Nashua Corp discloses the liquid crystal display having the light scattering film and the reflective polarizer, but in Nashua Corp the scattering film is placed between the reflective polarizer and the back light unit, whereas the present invention has the reflective polarizer between the scattering film and the back light unit. Furthermore, Nashua Corp teaches a scattering film which is polarization-maintaining film and does not disclose the relationship between the incident angle and the scattering performance.

SAR PLC teaches only the general formation of tubular microlenses and does not refer to the use of scattering film with controlled characteristics, such as disclosed in the present invention. Nashua Corp teaches that SAR PLC amongst other published inventions and documents (page 10, 2nd paragraph) may be used to form tubular microlenses, but there is no teaching that tubular structures are preferred over any other structure or guidance to uses such structures. In fact a "random array" (page 10) is preferred. Additionally, SAR refers to screens and not to a liquid crystal display.

Yano teaches very generally that the degree of transmittance in the normal direction is a variable affecting the viewability of displays. However, the scattering film of Yano, which contains colorless light transmissible particles (Fig 3 of Yano) and which do not have any anisotropy, does not have any relationship between the incident angle and the scattering performance. As a result Yano neither teaches nor discloses the use of the type of scattering film disclosed in the

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present invention and therefore cannot predict the relationship between the incident light in an oblique direction effectively. Figure 1 in the present application shows the relationship between transmittance and viewability angle of a film with particles (Yano's disclosure), and it can be seen that there is a broad scattering of light over a wide angle and the scattered light shows a distribution which only changes moderately in all angles, i.e. there is no "W" type of change in the transmittance such as the effect seen in Figure 6 of the present invention. Thus one of ordinary skill in the art would not look to Yano for determining the optimum relationship between the incident angle and the maximum scattering performance, since no such relationship exists for Yano's invention. One would not look to Yano to modify the prior art cited by the Examiner. Thus there is no motivation to combine Yano with Nashua Corp and/or SAR PLC disclosures. Furthermore, the even more specific relationship at around 20 degrees (new claim 18) is definitely not obtainable from Yano or the combination of Nashua in view of SAR and in view of Yano.

The Examiner is using hindsight in combining the 3 prior art references to arrive at the applicant's present invention. Yano refers to a very different type of scattering film, SAR PLC only teaches how to make microlenses for screens, and Nashua does not describe the arrangement of the presently claimed device. Thus there is no teaching or motivation needed to modify the prior art to arrive at the present invention. Thus the applicant believes that these references cannot be combined and request that they be removed.

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In view of the above amendments and remarks, the present application is believed to be in condition for allowance, and reconsideration of it is requested. If the Examiner disagrees, he is requested to contact the attorney for Applicants at the telephone number provided below.

Respectfully submitted,



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